

INTEGRATED ATMOSPHERIC DEPOSITION NETWORK

QUALITY ASSURANCE PROGRAM PLAN

REVISION 1.1

**Environment Canada
United States Environmental Protection Agency**

June 29, 2001

**APPROVAL OF THE
INTEGRATED ATMOSPHERIC DEPOSITION NETWORK (IADN)
QUALITY ASSURANCE PROGRAM PLAN (QAPP)**

This Quality Assurance Program Plan is approved for implementation by the participating agencies in the IADN program.

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LIST OF ACRONYMS

ADQ	Audit of Data Quality
AIRS	Aerometric Information Retrieval System
APIOS	Acidic Precipitation in Ontario Study
BEC	Binational Executive Committee of the GLWQA
CAA	United States Clean Air Act
CAPMoN	Canadian Air and Precipitation Monitoring Network
CCIW	Canada Centre for Inland Waters
COA	Canada - Ontario Agreement
DBM	Database Manager
DQI	Data Quality Indicator
DQO	Data Quality Objective
EC	Environment Canada
EHD	Ecosystem Health Division (Environment Canada)
GC	Gas Chromatography
GC/MS	Gas Chromatography / Mass Spectrometry
GC/ECD	Gas Chromatography / Electron Capture Detector
GLAD	Great Lakes Atmospheric Deposition (U.S.)
GLNPO	Great Lakes National Program Office (U.S.)
GLWQA	Great Lakes Water Quality Agreement (U.S. & Canada)
HCB	Hexachlorobenzene
HCH	Hexachlorocyclohexane
IADN	Integrated Atmospheric Deposition Network
IDL	Instrument Detection Limit
IJC	International Joint Commission
ILOD	Interim Limit of Detection
IP1	First IADN Implementation Plan (1990)
IP2	Second IADN Implementation Plan (1998)
IU	Indiana University
LOD	Limit of Detection
MDL	Method Detection Limit
MQO	Measurement Quality Objective
MSC	Meteorological Services of Canada
MSR	Management Systems Review
NAtChem	National Atmospheric Chemistry Database (Canada)
NLET	National Laboratory for Environmental Testing (Canada)
NWRI	National Water Research Institute (Canada)
OME	Ontario Ministry of the Environment (Canada)
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PE	Performance Evaluation
PI	Principal Investigator
POP	Persistent Organic Pollutant
QA	Quality Assurance
QAM	Quality Assurance Manager (Program Wide)
QAPP	Quality Assurance Program Plan
QAPjP	Quality Assurance Project Plan
QC	Quality Control
QCC	Quality Control Coordinator
RDMQ	Research Data Management Quality Assurance System
SAS	Statistical Analysis Software
SC	IADN Steering Committee

SOP	Standard Operating Procedure
TOC	Total Organic Carbon
TS	IADN Technical Summary, 1997
TSA	Technical Systems Audit
TSP	Total Suspended Particulate Matter
US-EPA	United States Environmental Protection Agency

SECTION 1.0

INTRODUCTION

1.1 BACKGROUND

The quality of water in the Great Lakes has been a subject of concern to both Canada and the United States since the early 20th century. In response to this concern, the Boundary Waters Treaty and the International Joint Commission (IJC) were created in 1909. The Great Lakes Water Quality Agreement (GLWQA) was enacted in 1972. During the 1970's, studies spurred by the GLWQA showed that a number of pollutants created a potential threat to the Great Lakes ecosystem, and that atmospheric deposition may be a major route of introduction for these pollutants to the lakes.

In 1987, a new protocol was signed and several annexes were added to the GLWQA, including Annex 15, which specifically addresses airborne toxic substances, including research, surveillance and monitoring, controls, and health effects. In response to Annex 15, the International Joint Commission, in a 1988 report, outlined a plan regarding airborne toxics. Central to the plan was the creation of an Integrated Atmospheric Deposition Network (IADN), comprised of both U.S. and Canadian monitoring stations. The United States involvement in this effort was accelerated by the 1990 amendments to the United States Clean Air Act (CAA), which added impetus to the program through Title III, Section 112 (m), which called for the establishment of a Great Lakes atmospheric deposition monitoring network.

In 1971, the first Canada-Ontario Agreement on Great Lakes Water Quality (COA) was signed. The COA has been renewed several times and reflects a continuing commitment between Federal and Provincial governments to the improvement of water quality in the Great Lakes. The COA provided the basis for the Ontario Ministry of Environment's participation in the IADN Program.

In 1989, the Canada-Ontario Agreement created an Air Toxics Committee under the leadership of the Meteorological Service of Canada (MSC, formerly Atmospheric Environment Service or AES), and this group developed plans to implement Annex 15 on the Canadian side. The Canadian effort identified which chemicals should be monitored, what the criteria for an IADN site should be, what equipment would be needed, and what QA/QC program was needed.

Liaison with the EPA's Great Lakes National Program Office was initiated and a meeting was held in Detroit on December 4-5, 1989 to agree on details for a program for IADN and potentially for Annex 15. The outcome of that meeting was the formation of three working group reports which further defined the IADN network activities. In early 1990, the process was formalized with a signed 6-year Implementation Plan (Egar and Adamkus, 1990). This has been subsequently identified as the first Implementation Plan (IP1).

In 1997, the progress of the IADN program was reviewed in a technical summary (IADN Steering Committee, 1997) and this report was the subject of a Peer Review by eminent scientists of international stature. Based on this review, a second Implementation Plan (IP2) was signed, which outlines the plans for IADN for the period 1998-2004 (Mills and Gulezian, 1998).

1.2 SCOPE AND PURPOSE

This Quality Assurance Program Plan (QAPP) outlines the Quality Assurance (QA) activities necessary to ensure that data of sufficient quality are produced by the parties participating in IADN to meet the program goals. The original QAPP (1994) reflected the goals of IP1. This version reflects the goals of IP2 and the achievements of IP1, as summarized in the Technical Summary (IADN Steering Committee, 1997).

As with the original QAPP, this document contains information of a general nature regarding QA requirements for all parties involved in the IADN. Details of sampling and analytical techniques, data management procedures, and other matters related to the data collection activities are covered in the Quality Assurance Project Plans (QAPjP), Standard Operating Procedures (SOP), and technical manuals developed by each group performing data collection activities. QAPPs and QAPjPs work together as an integrated whole, covering all aspects of a complete QA program for the IADN.

1.3 RATIONALE AND APPROACH

A general discussion of IADN's mandate and goals is found in the network's second implementation plan, IP2 (see Appendix B). IP2 outlines the current design of the network and proposed modifications for satellite stations. One Master Station has been established for each of the lakes and is equipped with air samplers, precipitation collectors, and instruments to record

meteorological information. Satellite stations, which are part of participating agency networks extending beyond IADN, contribute additional data.

A central database is maintained by the Meteorological Service of Canada (MSC) of Environment Canada. Each agency provides its data to the IADN data manager who processes it through the Research Data Management and Quality Control System (RDMQTM). After various QA/QC checks, the final IADN dataset is transferred to NAtChem (National Atmospheric Chemistry database), a repository for many North American air quality datasets. Data generation and management in the network are fully described in Section 4.

IADN's fundamental work consists of measuring environmental concentrations of selected toxic substances and using them as inputs to a model that estimates their atmospheric loadings to the Great Lakes Basin. The rationale behind the conversion of measured concentrations to loadings lies in the nature of the toxicity of the substances involved. For the most part, these substances exhibit their toxicity through the aquatic food chain where, even though concentrations in water may be low, the substances bioaccumulate to toxic levels in aquatic organisms. Temporal and spatial trends in concentrations measured by IADN are also relevant in terms of progress toward IADN goals.

Atmospheric loadings are determined by estimating the contribution of each of the relevant atmospheric pathways to the lakes (see Figure 1).

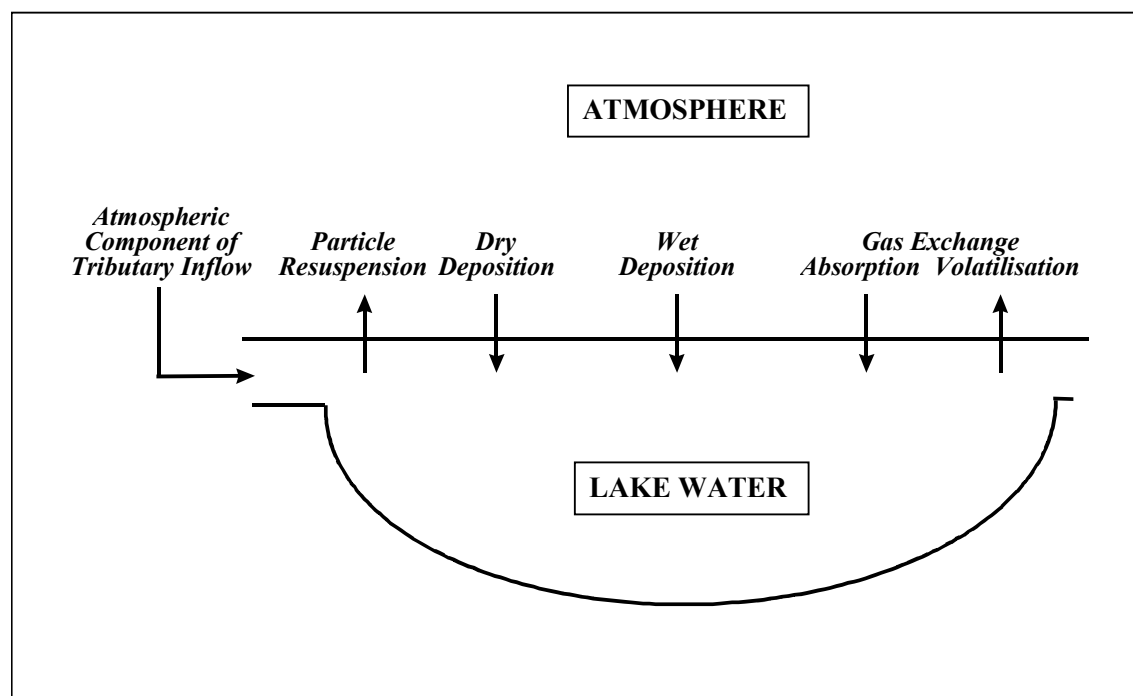


Figure 1. Atmospheric pathways for toxic contaminants considered in IADN.

The net atmospheric loading is the sum of the individual loading components:

$$L = L_t - RS + D + P + G$$

- L = Net atmospheric loading
- L_t = Atmospheric component of tributary loading to lake
- RS = Resuspension of particles from lake water to air
- D = Dry deposition of particles to lake
- P = Wet deposition (precipitation) to lake, including fog
- G = Net gas exchange expressed as the sum of gas absorption and volatilisation

Note that neither the tributary nor particle resuspension terms (L_t and RS, respectively) is currently estimated by the network; nor is the fog component of the wet deposition. The loading equation therefore reduces to

$$L = D + P + G$$

with each loading component calculated as follows if expressed in mass flux terms (mass per unit area per unit time).

$$D = C_{a,p} v_d$$

where

- D = dry deposition ($\text{ng} \cdot \text{m}^{-2} \cdot \text{d}^{-1}$)
- $C_{a,p}$ = concentration in particle phase of air ($\text{ng} \cdot \text{m}^{-3}$)
- v_d = dry deposition velocity of airborne particles ($\text{m} \cdot \text{d}^{-1}$)

$$P = C_p R_p$$

where

- P = wet deposition ($\text{ng} \cdot \text{m}^{-2} \cdot \text{d}^{-1}$)
 C_p = concentration in precipitation ($\text{ng} \cdot \text{m}^{-3}$)
 R_p = rate of precipitation ($\text{m} \cdot \text{d}^{-1}$)

$$G = k_{o,l} (C_{a,g} R T H^{-1} - C_w)$$

where

- G = net gas exchange ($\text{ng} \cdot \text{m}^{-2} \cdot \text{d}^{-1}$)
 $k_{o,l}$ = mass transfer coefficient ($\text{m} \cdot \text{d}^{-1}$)
 $C_{a,g}$ = concentration in gas phase of air ($\text{ng} \cdot \text{m}^{-3}$)
R = gas constant ($\text{Pa} \cdot \text{m}^3 \cdot \text{mol}^{-1} \cdot \text{K}^{-1}$)
T = temperature at the air-water interface (K)
H = Henry's Law constant ($\text{Pa} \cdot \text{m}^3 \cdot \text{mol}^{-1}$)
 C_w = concentration in lake water ($\text{ng} \cdot \text{m}^{-3}$)

These mass fluxes can be converted to lakewide loadings by multiplying by the area of the lake affected by each component. In general, IADN assumes that all processes are represented by the conditions measured at the Master Stations. Therefore, the appropriate lake areas are estimated as the total lake areas.

An important adjunct to the loading calculated by the IADN model is the estimate of its associated variability. In IADN, this variability is expressed as the coefficient of variation, and arises from the use of average values over the temporal and spatial domains as well as from the uncertainties associated with the physico-chemical parameters used to generate model results. The error estimates used in the IADN model are listed below. A thorough discussion of the derivation of the estimates and the effect of reducing uncertainties in the model was presented by Hoff (1994).

Uncertainty estimate for Dry Deposition

$$e_D^2 = e_{Ca,p}^2 + e_{vd}^2$$

where

- e_D = error estimate for dry deposition loading

- $e_{Ca,p}$ = variability in measured concentration in particle phase of air
 e_{vd} = estimated error in dry deposition velocity of airborne particles

Uncertainty estimate for Wet Deposition

$$e_P^2 = e_{Cp}^2 + e_{Rp}^2$$

where

- e_P = error estimate for wet deposition loading
 e_{Cp} = variability in measured concentration in precipitation
 e_{Rp} = estimated error in rate of precipitation

Uncertainty estimate for Gas Exchange

$$e_G^2 = e_{K_{o,l}}^2 + [C_{a,g} R T H^{-1} (C_{a,g} R T H^{-1} - C_w)^{-1}]^2 [e_{Ca,g}^2 + e_T^2 + e_H^2] + [C_w (C_{a,g} R T H^{-1} - C_w)^{-1}]^2 [e_{Cw}^2]$$

where

- e_G = error estimate for gas exchange
 $e_{K_{o,l}}$ = estimated error in mass transfer coefficient
 $e_{Ca,g}$ = variability in measured concentration in gas phase of air
 e_T = estimated error in temperature at air-water interface
 e_H = estimated error in Henry's Law coefficient
 e_{Cw} = variability in measured lake water concentration

1.4 NETWORK DESIGN

IADN consists of a series of Master and Satellite monitoring stations, a suite of chemicals monitored, a quality control program and a central database for the data generated. Details of the network can be found in Appendix B.

1.4.1 Stations

IADN has been designed with one Master Station on each of the five Great Lakes, supplemented by a number of Satellite Stations to provide spatial detail for deposition. Sampling

for the complete range of measurements made in the Network, including Semivolatile Organic Compounds (SVOCs) and trace metals is done at the Master Stations. IADN also estimates gas exchange of the SVOCs with the lake surfaces by using the air concentration measurements of the SVOCs at these sites in combination with water concentration measurements of the same chemicals made by other programs. Master Stations were started between 1988 and 1992 and are located at Eagle Harbor (Superior), Sleeping Bear Dunes (Michigan), Burnt Island (Huron), Sturgeon Point (Erie) and Point Petre (Ontario). Analysis of samples from Satellite Stations may include only a portion of the measurements made at the Master Stations and after 2000 are only sampled for precipitation. IADN is developing paired urban/rural or urban/remote stations to assess the impact of large urban areas on the Lakes. An urban station near Chicago has been started and a sampling buoy research site to investigate gas exchange over Lake Ontario near Toronto is under development.

1.4.2 Chemicals Measured

The proposed list of chemicals to be monitored during IP2 is shown on page 7 of Appendix B. Tier 1 chemicals were defined as “those which exhibit a combination of high environmental priority, well-developed method and established infrastructure, and for which it can be expected that IADN will continue to produce quality assured data for the full period”. Tier 2 included high-priority chemicals that would be subject to analysis only at selected sites. Tier 3 included important substances with an atmospheric pathway for which method development was still needed.

At the January 2000 QA workshop in Niagara-on-the-Lake, the IP2 chemical list was examined with regards to what was currently being reported by IADN laboratories. Each laboratory attempted to add any substances that were in high tiers, but not on their current parameter list. A review of lists of substances judged as important by various Great Lakes programs and agreements, including Annex 1 of the Great Lakes Water Quality Agreement and the U.S.- Canada Binational Toxics Strategy, was performed. It was assumed that these programs targeted chemicals that were high-priority in terms of the environmental health of the Great Lakes. With the exception of mercury and dioxins/furans, which are being measured by other U.S. and Canadian monitoring programs and may be incorporated into IADN monitoring in

the future, the IADN list covered the great majority of target chemicals from the program lists.

A final chemical list (Table 1-1) was constructed based on available air and precipitation data from each of the laboratories. The term “tier” was removed, because the list reflects what is currently feasible and available rather than a hierarchy of importance. The first part of the list, “Chemicals Measured at all Master Stations in Air and Precipitation”, reflects the spirit of Tier 1 from IP2 in that the substances included reflect what is possible for participating agencies taking into account “well-developed method and established infrastructure”. For the most part, all IP2 Tier 1 chemicals are being monitored by IADN, with the exceptions of metals on the U.S. side and some PAHs.

The availability of loadings information for the IADN chemicals was also included in this revision of the chemical list. However, the availability of calculated loadings depends on more than just air data, since other parameters, including lake water concentration data, are required.

Table 1-1: IADN Chemical List, Revised 5/2000

Chemicals Measured At All Master Stations In Air And Precipitation	
PCBs (84 congeners/56 congener groups and ΣPCB suite)	
Organochlorine pesticides:	Methoxychlor
Aldrin	Trans-nonachlor
trans-chlordane (γ)	
cis-chlordane (α)	Polycyclic aromatic compounds:
p,p'-DDT	Anthracene
p,p'-DDD	Benz(a)anthracene
p,p'-DDE	Benzo(b)fluoranthene
o,p'-DDT	Benzo(k)fluoranthene
Dieldrin	Benzo(ghi)perylene
α-endosulphan (I)	Benzo(a)pyrene
β-endosulphan (II)	Chrysene + Triphenylene
Endrin	Dibenz(a,h)anthracene
Heptachlor epoxide	Fluoranthene
Hexachlorobenzene (HCB)	Indeno(1,2,3,cd)pyrene
α - HCH	Phenanthrene
β - HCH	Pyrene
γ - HCH (lindane)	
Additional chemicals for which data is available	
Monitoring done by at least 1 agency¹	
o,p'-DDD (MSC, IU/EPA)	Benzo(e)pyrene (MSC, IU/EPA)
o,p'-DDE (MSC)	2-chloronaphthalene (EHD)
Endosulphan sulphate (MSC, IU/EPA)	Coronene (MSC, IU/EPA)
Heptachlor (MSC, EHD)	Dibenz(a,c)anthracene (MSC)
δ - HCH (MSC)	Fluorene (MSC, IU/EPA)
Mirex (MSC, EHD)	Indene (EHD)
Octachlorostyrene (IU/EPA)	1-methylnaphthalene (EHD)
Oxychlordane (MSC, IU/EPA)	2-methylnaphthalene (EHD)
di-/tri-/tetra-/pentachlorobenzenes (EHD)	Retene (MSC, IU/EPA)
Photomirex (MSC)	1,2,3,4-tetrahydronaphthalene (EHD)
Acenaphthene (MSC, EHD)	Trace elements²:
Acenaphthylene (MSC, EHD)	As (MSC)
Anthanthrene (MSC)	Cd (MSC, EHD)
Benzo(ghi)fluoranthene (MSC)	Pb (MSC, EHD)
	Se (MSC)

Chemicals for which loadings estimates are available (Based on loadings report published 5/2000)	
trans-chlordane	ΣPCBs
cis-chlordane	Individual PCB congeners 18, 44, 52, 101
p,p'-DDD	
p,p'-DDE	Benzo(b)fluoranthene
p,p'-DDT	Benzo(k)fluoranthene
Dieldrin	Benzo(a)pyrene
α-endosulphan	Indeno(1,2,3,cd)pyrene
β-endosulphan	Phenanthrene
Endosulphan sulphate	Pyrene
Hexachlorobenzene (HCB)	
α-HCH	As
γ-HCH	Cd
trans-nonachlor	Pb
	Se

1 Participating agencies are the Meteorological Service of Canada (MSC), part of Environment Canada and formerly Atmospheric Environment Service (AES); Ecosystem Health Division of Environment Canada (EHD); and the U.S. Environmental Protection Agency in cooperation with Indiana University (IU/EPA).

2 Samples at U.S. stations have not been analyzed for metals since 1994.

In June 2001, plans were made for an analysis of percent detection with the goal of developing criteria for adding substances to the list of chemicals for which loadings are calculated (and possibly for dropping chemicals from the IADN measurement list). In the future as banned substances fall below detection levels, it may be necessary to shift resources to new substances of concern while at the same time meeting obligations under agreements that cover “old” substances and considering methodological limitations. The Steering Committee will have to determine when a substance can be considered “virtually eliminated” and can be dropped from IADN’s measurement list.

Stakeholders can nominate new chemicals that must be toxic to humans or other species and have a significant atmospheric pathway of transport. The IADN Steering Committee will conduct a review of each nominated chemical. The list of nominated substances will be subject to budgeting processes in both countries.

On May 16, 2000 the IADN Steering Committee adopted a suite of 84 PCB congeners in 56 groups to accommodate co-eluting congeners (herein known as the “IADN PCB Suite”; see Table 1-1) for the purposes of estimating total PCBs in air and precipitation. PCB congeners are numbered according to the system of Ballschmiter and Zell (1980). The selection of congeners

was based on 1995 and 1996 air and precipitation results from the 5 Master stations, against the following criteria:

- a) the congener was common to all agencies reporting PCB congener results at the time (MSC, Indiana U, NWRI); and
- b) it contributed >1% to the %total PCB mass for at least one site; or
- c) it was one of the toxicologically important congeners (77, 105, 118, 126, 128, 138, 156, 169 and 170); or
- d) it had been previously identified in a similar effort by Hoff to have contributed significantly to the PCB congener mass in 1997 air samples collected at Eagle Harbor.

Table 1-2. IADN PCB suite congeners.

PCB#	PCB#	PCB#	PCB#	PCB#
4+10	31	74	100	156+171+202
5+8	33+53	77+110	101	169
6	37+42	83	105+132+153	170+190
7+9	41+64+71	84+92	114+131	172
12+13	44	85	118	174
15+17	45	87+81	119	180
16+32	47+48	89	123+149	194+205
18	49	91	126	199
19	52	95+66	128+167	201
22	56+60	97	135+144	206
26	70+76	99	138+163	207
28				

It is expected that all agencies will strive to measure these congeners, at a minimum. However a few congeners (9, 126, 169) are not currently analyzed by all laboratories. Future quality assurance efforts, including both laboratory round-robins and RDMQ, as well as future IADN loadings estimates (including trend reporting) will be based on the IADN PCB Suite.

1.4.3 Quality Assurance/Quality Control

QA/QC has been an important feature of the IADN program since its inception. As a result, the IADN Peer Review panel has recognized the importance and validity of data

obtained from IADN. The program operates under a Quality Assurance Program Plan (QAPP) which is updated at least every two years and each participating agency uses Quality Assurance Project Plans (QAPjPs) and Standard Operating Procedures (SOPs) for sampling and analysis activities. Interlaboratory comparison round robins, field sampling intercomparisons at the Point Petre master station and various program audits are carried out regularly. Data entering the database is subjected to a further quality assessment using RDMQ™.

1.4.4 Data Analysis and Reporting

In addition to analyzing, interpreting and publishing agency data on an individual basis, there is a binational commitment to report every two years on estimates of atmospheric loadings to the Great Lakes. Appendix J outlines the data reduction protocols employed to summarize the data, in preparation for derivation of loadings estimates. The equations used to derive the loads are as defined previously in this Section of the QAPP. The first and third IADN loadings reports (Hoff et al., 1996; Galarneau et al., 2000) were prepared by Environment Canada; the U.S. grantee prepared the second IADN loadings report (Hillery et al., 1998). Lead responsibility for preparing subsequent loadings reports will continue to alternate between the two countries.

At the conclusion of each Implementation Plan, a summary of progress made under the IADN program is prepared by the Steering Committee. This technical summary discusses fulfillment of the goals which were identified in the Implementation Plan; QA/QC results; spatial and temporal trends in concentrations and loadings; required changes to the program. This report forms the basis for discussion at an external review of the IADN program (see Section 5.4).

IADN data (including seasonal and annual summaries) and all resultant publications / products are available via the World Wide Web (www.msc-smc.ec.gc.ca/iadn/ and www.epa.gov/glnpo/iadn). IADN data release guidelines can be found in Appendix K.

1.5 HISTORY OF CHANGES / REVISIONS

1.5.1 Version 1.0 of this QAPP was originally written in 1994 to comply with US QAPP requirements of the day.

1.5.2 Version 1.1 of the QAPP, released June 29, 2001, was updated as a result of meetings

held in January 2000 and later in May 2001. The current QAPP reflects the Ontario Ministry of the Environment and National Water Research Institute as past participants, provides updated membership and organization charts and removes most discussion of Data Quality Objectives in favour on focussing on technology based Data Quality Indicators. Section 1.3 (Rationale and Approach) has been updated to include loading equations formerly contained in Former Appendix C which has been removed. Section 1.4 (Network Design) has been added as has a new Section 1.5 (History of Changes / Revisions) to assist in locating changes to the QAPP. Sections 3.5 (Responsibilities of Individuals), 4 (Data Generation and Management) and 5.1 (Description of the Audit Program) have been completely updated. Table 3-1 (Recommended Monitoring Network Documentation) has been rearranged. The Common Reference Standard has been introduced in Section 4.3.2. A new Appendix D (IADN Network Details) and Appendix G (Data Quality Indicators) contain the information formerly in Appendix I which has been removed. Former Appendix E (Annual IADN Timetable) has been removed. Appendix I (List of Standard Operating Procedures) and Appendix J (IADN Data Reduction Protocol) have both been updated. Appendix L (IADN Data Release Guidelines) has been added. As a result of these changes, many sections and Appendices have been re-numbered.

SECTION 2.0

QUALITY ASSURANCE POLICY STATEMENT

The IADN involves coordination of Federal and other agencies in both the United States and Canada, and makes use of state-of-the-science methods for sampling and analysis of chemicals which may not have standardized operational techniques or routine protocols. The IADN Implementation Plans (IP1 and IP2) require that agencies participating in the IADN produce data of comparable quality which meet clearly defined quality assurance objectives.

The Plan calls for monitoring of Data Quality Indicators (DQIs) for chemicals measured by the Network. DQIs are statements of data quality used to express measurement uncertainty such as precision, accuracy, representativeness, completeness, and comparability. DQIs in IADN are based on what is achievable through the current state of the art and serve as specifications of the quality of the data. A complete list of DQIs can be found in Appendix G.

The agencies participating in IADN commit to work together to meet the quality assurance objectives described in this QA Program Plan and to provide data of acceptable quality through compliance with the quality assurance procedures described in this document and through implementation of their own Quality Assurance Project Plans (or equivalent documents).

SECTION 3.0

ORGANIZATION AND RESPONSIBILITIES

3.1 ORGANIZATIONAL OVERVIEW

The United States Environmental Protection Agency's Great Lakes National Program Office (GLNPO) and Environment Canada's Meteorological Services of Canada (MSC) are primarily responsible for management and oversight of their respective portions of the IADN program. The framework for U.S.-Canadian cooperation is provided by the Great Lakes Water Quality Agreement (GLWQA). The International Joint Commission (IJC) is responsible for reviewing the IADN program to ensure it remains consistent with the objectives of the GLWQA.

For the United States, GLNPO is assisted by a grantee. From 1988 – 1992 the grantee was the Illinois State Water Survey (ISWS). From 1992 to the present (2001) the grantee has been Indiana University (IU). IU conducts data collection activities including field sampling and laboratory analysis.

For Canada, several Federal and other agencies are involved within a framework for cooperation provided by the Canada-Ontario Agreement (COA). Several agencies within Environment Canada (EC) have varying responsibilities for monitoring and analysis. The Meteorological Services of Canada (MSC) has primary responsibility for field operations and for laboratory analysis for their vapour and particulate samplers. The Ecosystem Health Division (EHD) of Ontario Region, EC, is responsible for monitoring of wet deposition and analyses of organics and trace metals in precipitation samples from their sampling devices. Analyses of samples for EHD are performed by the National Laboratory for Environmental Testing (NLET).

The National Water Research Institute (NWRI) contributed precipitation data to IADN up to the end of 1998, but has subsequently changed its role to research activities only. The Ontario Ministry of the Environment (OME) participated in IADN until 2000 when it changed its role to research activities only.

3.2 ORGANIZATIONAL CHARTS

Figure 2 is a functional organizational chart for the IADN showing the relationships among the participating agencies. Appendix E contains more detailed organizational charts for each agency.

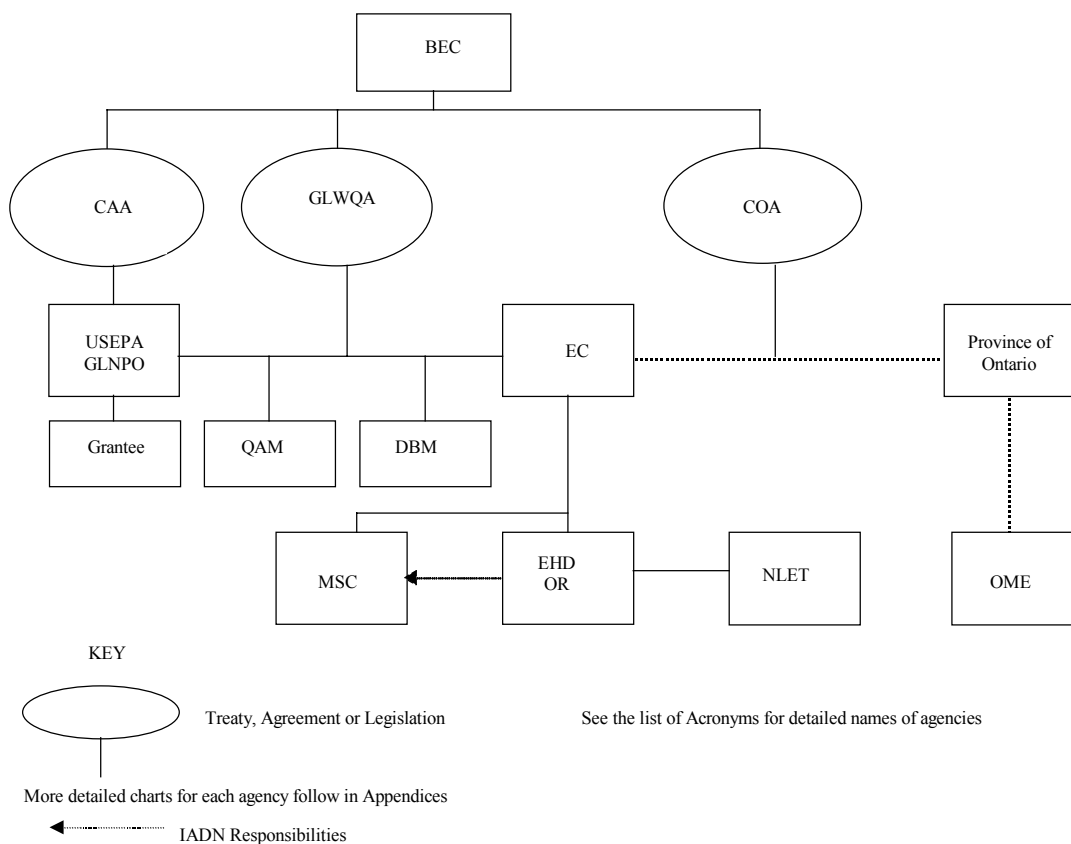


Figure 2. IADN Program Management Structure

3.3 RESPONSIBILITIES OF PARTICIPATING AGENCIES

3.3.1 Monitoring Responsibilities under Annex 15

Currently, three separate agencies are involved in monitoring activities as part of IADN : Environment Canada's MSC and EHD and the U.S. EPA. Each agency has its own monitoring and research programs, and there are some variations among the agencies regarding which pollutants and atmospheric pathways are investigated.

The MSC operates and maintains the Canadian master stations and is in charge of routine field operations for the Canadian portion of the IADN. They operate air samplers at all the master stations which collect suspended particulate and aerosols. These samples are analyzed (internally or by a subcontractor) for organics, and metals. Total suspended particulate matter (TSP) previously collected and analyzed on GFF filters (up to March 1998), is now collected using the TEOM PM2.5 or PM10 continuous sampler. The MSC is also responsible for collecting on-site meteorological data at the Canadian master stations.

The Ecosystem Health Division of EC operates an organic precipitation network in the Great Lakes Basin, with samplers at the two Canadian Master Stations. Samples collected by the EHD are analyzed for organics and metals by the National Laboratory for Environmental Testing (NLET). The National Water Research Institute of EC, formerly operated precipitation samplers at the Canadian master stations, and now focuses on its broader role in research directed at Annex 15 of the GLWQA.

The OME operated several monitoring programs in the Great Lakes Basin and throughout Ontario. Some sites established for the OME's Toxic Deposition Monitoring Program and Acid Precipitation in Ontario Study (APIOS) served as IADN satellite stations until the end of 2000. The Toxic Deposition Monitoring Network collected both air and precipitation samples at its own sites. The Toxic Deposition Monitoring Network's samples were analyzed for organics and metals by the OME's Laboratory Services Branch.

The U.S. EPA's GLNPO is responsible for IADN monitoring, sample analysis, program management and quality assurance. To provide the highest possible level of standardization in U.S. IADN monitoring and analysis, GLNPO has entered into a cooperative agreement with a university. Currently, Indiana University (IU) performs these functions. Samples collected by IU are analyzed for organics. Analysis of TOC was discontinued in August, 1996. Metals have not been analyzed at U.S. sites since 1995, but the IADN steering committee is exploring how to reinstate this analysis. Sample cartridges from the dichotomous sampler were being collected until November 2000.

3.3.2 Coordination Among Agencies

It is essential that the agencies which comprise the IADN work cooperatively. A Program Director (PD) from each country jointly oversees the IADN. A Steering Committee (SC), with membership from all participating agencies, oversees all the scientific and technical requirements and activities of the IADN. Current holders of these positions are provided in Appendix E.

Effective communication and exchange of information among the agencies participating in the IADN are essential for the network to function as a coordinated whole. MSC maintains a Web Page on the Internet with current information relating to IADN, as well as summary documents. The Canadian site is located at www.msc-smc.ec.gc.ca/iadn/ The U.S. IADN web site address is www.epa.gov/glnpo/iadn/.

In addition to the responsibilities described in this section, there will be other duties required of agencies participating in the IADN. Systems and performance audits will be performed on a regular basis for all IADN participants. Agencies and contractors, grantees, and subcontractors will also take part in intercomparison studies of sampling and analytical techniques. Ad hoc studies and audits may be performed from time to time, and all agencies involved in IADN will participate.

3.3.3 Delivery of Data

Agencies provide valid data to the IADN Database Manager (DBM) within an eighteen-month turnaround period for each calendar year, e.g. all 1998 data should be delivered by end of June 2000.

The data must be in a format compatible with the IADN central database, and both hard copy and magnetic media versions must be supplied. All agencies that participate in IADN will submit their data to the central database in the format chosen by the SC and meet the requirements of RDMQ. Every effort is made to standardize as many aspects of the data management process as possible.

3.3.4 Documentation

Proper documentation of all aspects of network operations is essential to an effective QA program. Table 3-1 is a summary of the recommended IADN documentation requirements.

Table 3-1. Recommended monitoring network documentation

TABLE 3-1. RECOMMENDED MONITORING NETWORK DOCUMENTATION			
IADN Steering Committee Documentation			
Classification	Report to	Document Type	Suggested Contents
QAPP	- SC	- Quality Assurance Program Plan	- Overall quality planning document as per Appendix F
Reports	- Public - SC - SC - SC - SC - SC - BEC	- Biennial Loading and Trends Report - Data Reports every 2 years - Quality Assurance Summary Report every 2 years - External audit report - SC minutes and discussion papers - Decision log - Report to BEC	- Description of progress, deposition loading estimates, QA summary - Quality assured data in IADN format - Description of QA activities and planned QA activities as appropriate, summary of QA data (including field and laboratory). Description of QA activities for each special study - Results of individual external audits - Action item lists - Record of major decisions by SC - Technical summary prepared at the conclusion of each Implementation Plan
Individual Agency Documentation			
Classification		Document Type	Suggested Contents
Reports	- DBM	- Annual Data Transmission	- Raw data submitted to RDMQ
Audit Reports	- Agency	- Internal Audit Documentation held by each agency	- Results of individual internal audits
Log Books or Journals	- Site - Lab - DBM - DBM	- Site Operator's Log - Laboratory Analyst's Notebook - Principal Investigator's Log - Database Manager's Log	- Sampling and instrument problems, samples submitted, corrective actions, preventative maintenance - Analysis details, sample logs, calibrations - History of changes or revisions to documentation - "Diary" of database changes/revisions (kept on computer)
Manuals	- Site - Site or lab - Lab - Agency	- Site Operator's Documentation - Instrument/Technical Documents - Laboratory Operations Manual - QA Project Plan (or equivalent)	- Instrument description and maintenance, standard operating procedures, QA/QC procedures, corrective action - Description of instruments, manufacturer's instructions, calibrations, procurement, inventory control, preventative maintenance, corrective action, QA/QC procedures - Laboratory organization, analytical and sample handling SOPs, corrective action, QA/QC procedures, instrument logs - Detailed description of QA procedures (see Section 4.2)

3.4 COMMITTEE MEMBERSHIP AND RESPONSIBILITIES

The management structure for the IADN coordinates operations of the agencies implementing the program and promotes consistency of methods whenever possible. Four major areas that require coordination are sampling and analysis techniques, quality assurance, data interpretation, and data management. Appendix E lists current members of the Steering Committee, their addresses, telephone and fax numbers. This group meets on an annual basis and maintains more frequent contact with monthly conference calls.

3.4.1 IADN Program Direction

A representative from Canada and the United States each serves as a Program Director (PD), and they jointly oversee the IADN. Responsibilities of the IADN PD include:

- Oversee and manage the IADN program
- Advocate the IADN program and seek and allocate resources
- Develop long-term plans
- Lead science and policy reviews of program
- Review and approve IADN reports such as deposition estimates and biennial reports
- Review and approve the IADN QAPP and its updates

The PDs are also responsible for officially representing the program at Binational Executive Committee meetings, State of the Lakes Ecosystem Conference, and to senior management in respective countries.

3.4.2 Steering Committee (SC)

This committee is composed of active participants representing each agency in IADN, including laboratory, field, and data operations. There is a co-chair from Canada and the United States. The Steering Committee reports to Program Directors. Responsibilities of the SC include:

- Coordinate cooperation among agencies
- Implement the IADN program to meet requirements as outlined in Annex 15
- Develop implementation plans including identifying parameters and locations for measurements, and identifying deliverables and timelines
- Document and maintain program procedures and protocols
- Produce required reports and loading estimates according to established schedules (Table 3)
[loadings report is produced on an alternating basis Canada/US]
- Conduct outreach programs in IADN, ie. Web site, factsheets, etc..

3.4.3 Ad Hoc Workgroups

The IADN PDs or Steering Committee may form ad hoc workgroups as needed to address specific concerns. These groups will meet as long as necessary to meet their objectives and then disband.

3.5 RESPONSIBILITIES OF PARTICIPATING AGENCIES, IADN DBM AND QAM

3.5.1 Participating Agency

These individuals may have various titles (Program or Project Manager, Program Leader, Network Coordinator, Field Manager, etc.) depending on the agency they are associated with, but they are generally identified by their managerial roles and association with the agencies providing funding and support to the groups performing the monitoring and analysis. Responsibilities of the Agencies (GLNPO/Grantee, MSC, and EHD/NLET) include:

- Implement the respective components of the IADN program and adhere to the QAPP requirements
- Ensure that QA requirements are met including the monthly analysis of the Common Reference Standards (PCB, OC, PAH)
- Appoint a Quality Control Coordinator (QCC) for each laboratory, usually the lab director
- Ensure corrective actions are taken
- Participate/Review and approve all QA documents and activities
- Participate/Review and approve all IADN data and reports

- Review and evaluate QA implementation and progress
- Schedule and arrange internal audits of laboratory and field, operations and equipment quarterly. Have results available for external audits.
- Develop and update the QAPjP as necessary, including DQIs
- Develop Site Operator's Manual, Technical Manual and other SOP's and provide copies to the DBM and QAM.
- Maintain records of all QC/QA activities
- Review and assess field and laboratory data quality regularly
- Report QA/QC problems and resolutions to the IADN DBM and QAM
- Maintain agency database and analyze data
- Participate in IADN workshops and ad hoc committees
- Deliver data, including field, laboratory and sample history documentation to the IADN DBM following specified protocols

3.5.2 IADN Quality Assurance Manager (QAM)

Overall QA management of the IADN program will be the responsibility of a bi-national QA Manager (contract or staff) who will report to the Steering Committee. Responsibilities of the QAM include:

- Track the QA status of IADN projects
- Review and revise the QAPP as needed
- Prepare and submit biennial QA report and an annual QA plan
- Encourage and assist continual development of improved QA/QC systems and techniques
- Organize field and laboratory intercomparisons
- Develop external audit protocols
- Schedule and arrange audits of sites, and laboratories
- Maintain common reference standards
- Prepare a QA synthesis report every six years
- Coordinate biennial QA workshop

Assess effectiveness of each agencies QAPjP in achieving quality assurance goals (DQIs)

3.5.3 IADN Database Manager (DBM)

The IADN DBM is responsible for maintaining the bi-national IADN database and reports to the Steering Committee. The responsibilities of the IADN DBM include:

- Maintain and update the IADN database, including the log of changes and deletions
- Prepare data products for Biennial Data Workshop and Great Lakes Loading Estimate report
- Coordinate Biennial Data Workshop
- Provide oversight for data reviews and corrections to the database
- Develop data validation criteria
- Conduct biennial data traceability audit
- Gather, validate, update, and correct all data submitted by agencies
- Maintain a central QA/QC documentation archive
- Establish and maintain IADN web site, ftp and other information and data exchange media
- Provide support for database users and develop User's guide
- Create products (*e.g.*, data summaries, maps)
- Ensure security of the binational IADN database
- Respond to data requests as per recommended process (see Appendix M)

SECTION 4.0

DATA GENERATION AND MANAGEMENT

This section addresses QA/QC procedures related to the collection and management of IADN data. Section 4.1 describes the means used to assess the quality of the data generated by the IADN. Sections 4.2 and 4.3 describe the QA documentation that is required of all agencies that contribute data to the IADN. (Appendix F expands on section 4.2, providing guidelines for QA plans). Section 4.4 outlines the IADN data management system, including the general design of the database, data reduction methodology, and QC procedures for data management. Section 4.5 covers the responsibility of the Database Manager to make the data available to the scientific community and the public, including data retrieval and reporting requirements.

4.1 DATA OBJECTIVES

The stated purpose of the IADN is to assess loading of toxics to the Great Lakes through atmospheric pathways with a known degree of confidence. The model to be used to assess atmospheric loadings is based on the equations provided in Figure 1, Section 1.3.

In order to achieve the stated program goal, the concentrations, constants, and parameters which contribute to the terms of the loading equation must also be known to a specified degree of confidence.

Limitations in the current state-of-the-art for analysis of trace chemicals preclude the use of Data Quality Objectives. Instead, technology-based Data Quality Indicators (DQIs) are monitored as described in Appendix G. In reporting the data, errors in calculating loadings are estimated and limits of detection for each analyte in each phase are determined.

4.2 QUALITY ASSURANCE PROJECT PLANS

Each agency performing data collection activities as a part of IADN must have a clearly written QA Project Plan (QAPjP) or equivalent document. This includes all groups whose sites are used as satellite stations or who are operating sampling equipment at any of the master stations. The projects requiring a QAPjP include:

- MSC - Semi-Routine Monitoring Program
- IU - Deposition of Toxic Organic Compounds to the Great Lakes: IADN; US-EPA Grant #GL 995656-01
- EHD - Precipitation Monitoring

The following list includes the essential elements which must be covered by a QAPjP.

(See Appendix F for details on each point)

- Project description
- Project organization and responsibility
- Sampling procedures and siting criteria
- Sample custody
- Calibration procedures
- Analytical procedures
- Data reduction, validation, and reporting
- Internal Quality Control checks
- Performance and system audits
- Preventive maintenance
- Specific routine procedures to assess DQIs: precision, accuracy, representativeness, completeness, and comparability (PARCC)
- Corrective action
- QA reports to management
- QA for special studies

Canadian agencies are not required to comply with the format constraints imposed on QAPjPs for U.S. environmental data collection activities; they may organize the QA requirements in some other manner. However, they will address the content requirements listed above. The QAPjP may reference SOPs or other technical manuals for details of specific procedures, but should still contain a brief description of each subject.

4.3 SAMPLING AND ANALYSIS PROCEDURES

The IADN program has developed with different participating agencies using their own independent sampling and analysis methods and use of their own calibration strategies. Diversity in methods and standards can be a strength rather than a weakness of the program as long as the different approaches in use achieve similar results or at least constant biases.

4.3.1 Standard Operating Procedures

Each group performing environmental data collection activities for the IADN must have written standard operating procedures (SOP) for all important routine program elements including field operations, laboratory operations, and data management. See Appendices H and I for SOP development guidelines and a list of field and laboratory SOPs from groups participating in IADN.

4.3.2 Common Reference Standard

The need for a common reference standard was identified as a result of the IADN round robins held in 1992 and 1993. In 2000, the Steering Committee decided to prepare a common reference standard for the IADN suite of PCBs and for the IADN Pesticides and PAHs. Although these standards do not replace the existing calibration standards used in participating laboratories, they will be used as round robin standards and as independent check standards to verify continuing calibrations.

The Common Reference Standard is analyzed once per month and the results reported quarterly to the DBM who groups the PCB congeners according to the IADN suite and forwards the data to the QAM and SC. The QAM, PIs and the SC evaluate the data for comparability between laboratories and for trends which may indicate deterioration of standards.

Analysis for PCB congeners.

The Common Reference Standard is diluted into a preferred solvent and concentration range, combined into a single injection standard and run as an unknown against the regular calibration standard. No chemical manipulations other than the dilution and combining equal portions of the 3 ampoules is done. A measured volume is taken from the ampoules. Results of an injection of a combined sample is reported as the concentration in the original ampoule.

Analysis for PAH and Pesticides

The Common Reference Standard is diluted into a preferred solvent and concentration range and run as an unknown against the regular calibration standard. No chemical manipulations other than the dilution is done. A measured volume is taken from each ampoule.

Results are reported as the concentration in the original ampoule.

4.4 DATA MANAGEMENT

4.4.1 Data Control Procedures

All agencies participating in the IADN submit their quality assured data to the IADN database manager in a compatible format as outlined in Section 3.3.3.

4.4.2 Overall IADN Database Design

The central IADN database uses the Research Data Management and Quality Assurance System (RDMQ) and is maintained by MSC, with financial support from the other agencies. The overall data management structure is shown in Figure 3. Each agency is responsible for submitting their data set to the IADN central database. RDMQ is used to merge the field and laboratory data, QC the data sets, produce statistical and graphical reports, and distribute the complete, binational data set to the Canadian and U.S. agencies. A single database manager is responsible for maintaining RDMQ.

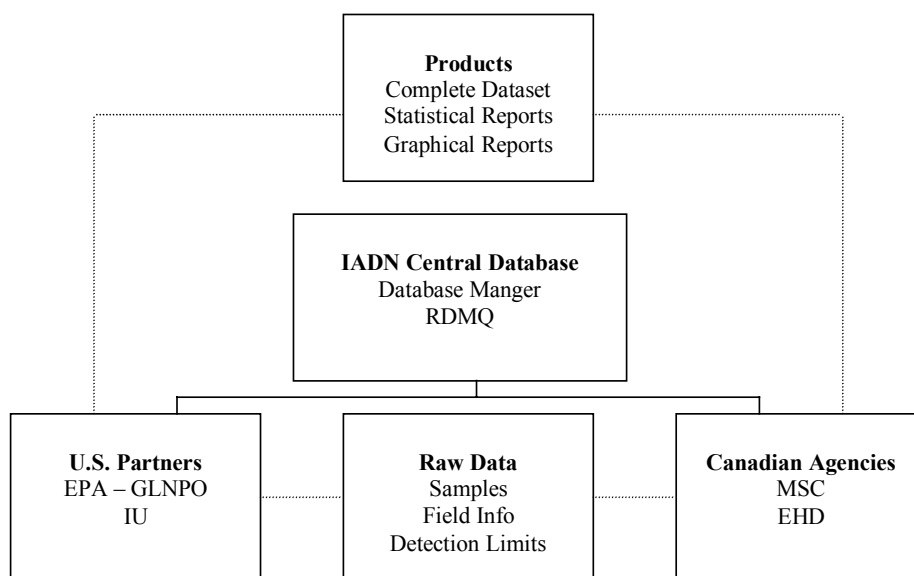


Figure 3 IADN Data Management Structure

Figure 4 shows the elements that make up the central IADN database. The database consists of four major sections, the network information system, the site information system, the IADN networks' data files and statistical data files. The network information system contains information on the IADN as a whole, including the number and types of sites, the pollutants being monitored, etc. The site information system will contain a detailed description of each IADN site, including location information, an assessment of compliance with siting criteria, a list of instrumentation, etc. The IADN data files contain several types of files: active samples, blank samples, blank corrected concentrations, and QC data. The statistical data files will contain the results of statistical analyses performed on IADN data by the DBM and others.

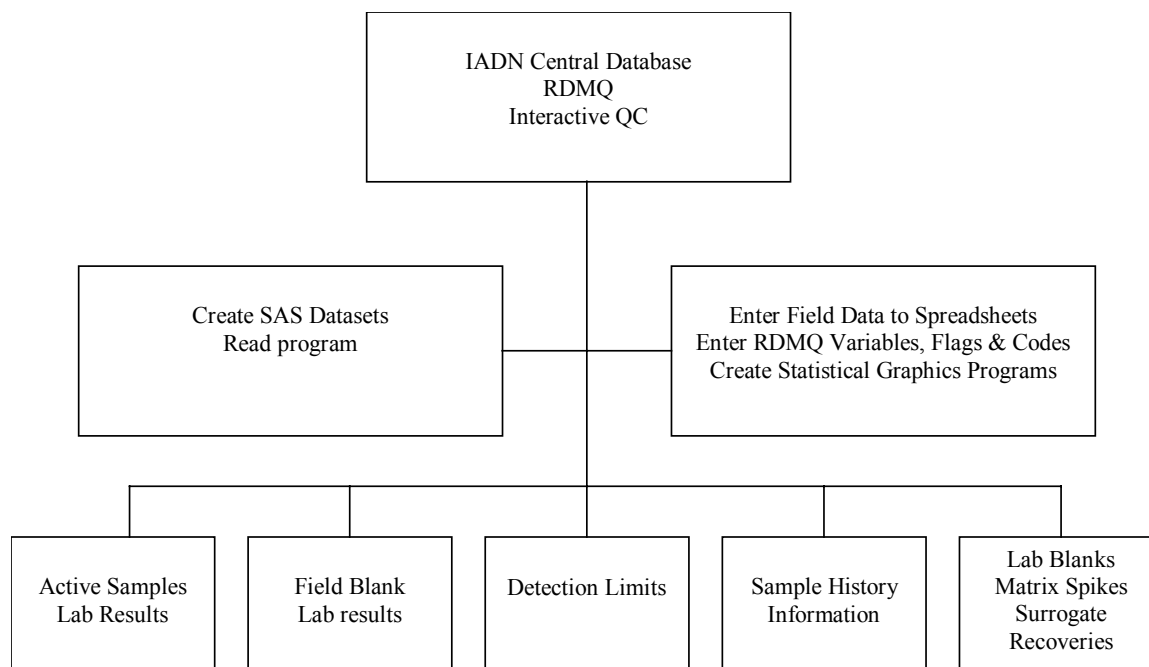


Figure 4 IADN Central Database Structure

Several important factors have been considered in the design of the central database:

- **Uniformity** - The Research Data Management Quality Control System (RDMQ) is a SAS based program designed to quality control large data sets. The codes and flags assigned to each data set are consistent with each agency. The program calculates outliers and derived variables (e.g., duration, volume), assigns warning flags, and allows interactive editing. This program sets the format for all data files, including the flags and codes used to annotate

entries. A set of flags and codes has been developed for each focus (e.g., pcbo, pah, metals, TSP/TOC, met).

- Storage flexibility - The database is relational and allows for changes in format resulting from possible program changes. RDMQ allows for the addition of variables due to the possibility of additions to the list of monitored toxic compounds.
- Input flexibility - Various spreadsheet and database file types have been submitted by agencies. The spreadsheets are manipulated to fit the RDMQ read program format and to ensure consistent variable names.
- Output flexibility - The database provides a variety of reporting formats for users, including maps, statistical summaries, and raw data. The databases will be delivered in ASCII file format.

Read-only online access to the data will be available to the public through the World Wide Web (www.msc-smc.ec.gc.ca/iadn/ and www.epa.gov/glnpo/iadn). Once validation and evaluation is complete, the seasonal and annual summaries will be available for public access.

4.4.3 Data Reduction

A standard data reduction protocol is necessary to provide comparability of data. The data reduction protocol described in Appendix J has been developed for use for the IADN. All agencies are to make every effort to conform to it. Any refinements or modifications to the data reduction protocol are to be made by the SC. All modifications to the data reduction protocol are to be documented.

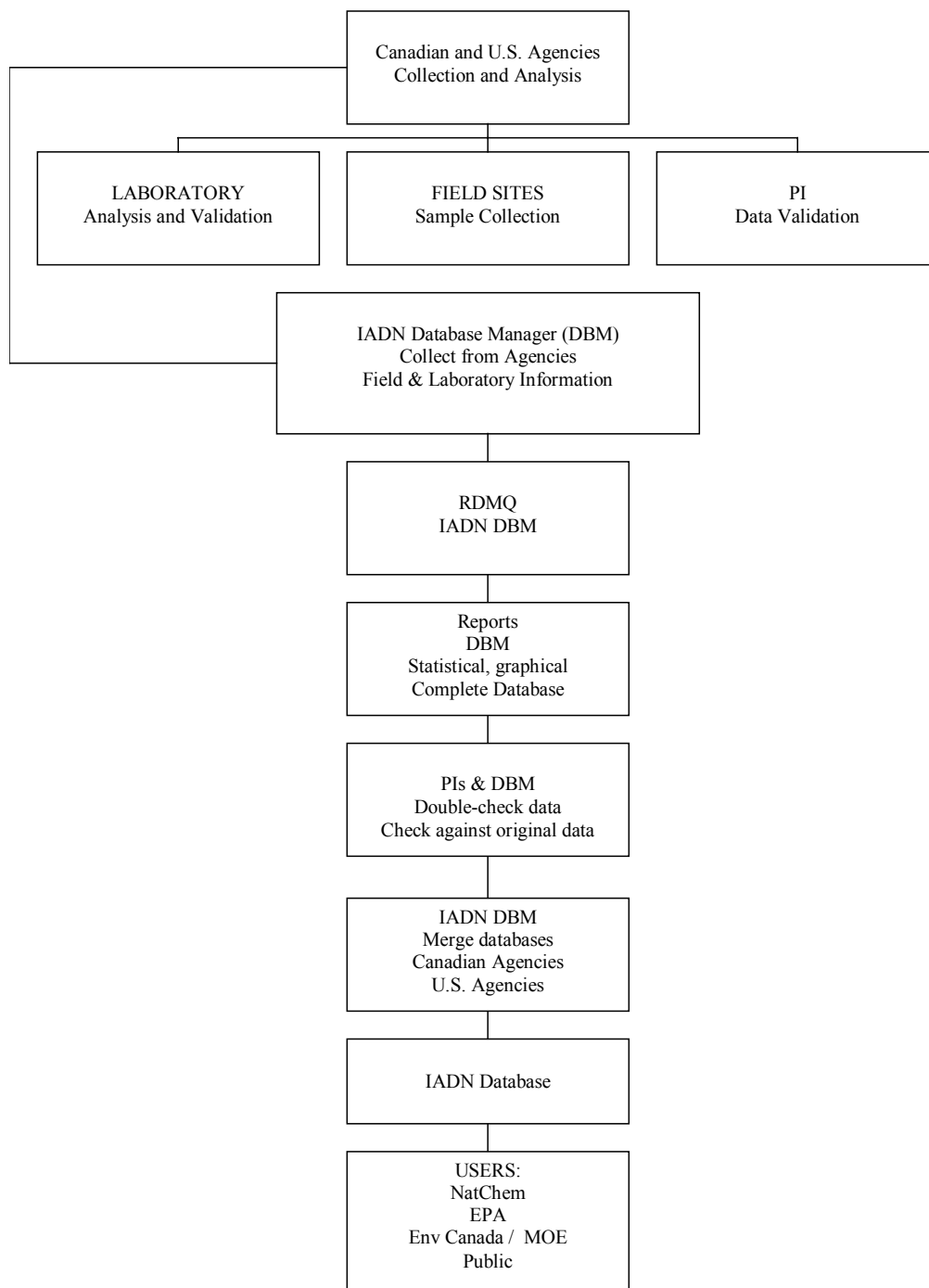


Figure 5. IADN Data Flow

4.4.4 Data Management Quality Control Procedures

Data Review And Intercomparison

Figure 5 is a schematic diagram of the flow of data from collection in the field to entry into the database. Before entry into the database, all data sets must pass three levels of review and intercomparison.

- The first level is performed at the individual agency. The Principal Investigator (PI) examines the data resulting from laboratory analyses and compares them to documentation from the field sites, checking that all appropriate validation codes have been added and no logistical mistakes have been made (*e.g.*, mislabeled samples, etc.).
- Sample analysis and history spreadsheets, field and lab notes are submitted to the IADN Database Manager for input into RDMQ. The Database Manager and the Principal Investigators develop flags and codes to annotate the data that will be screened through RDMQ.
- A Focus is created for each agency and each parameter, PCB, Pesticides, PAH, Metals, etc., within RDMQ. The outliers are calculated and the flags are applied according to the SAS codes that have been written for that particular focus. Flags, codes and statistical programs are consistent for each parameter. The screening is performed by the DBM using RDMQ. The project datasets then undergo additional checks with the DBM and PIs, by comparing them to the original data. Statistical reports of the mean blanks, IDLs, Seasonal, Annual and time series are used to compare to each agencies original data.

The agency data sets are then merged by the IADN DBM, and must undergo three further checks before being entered into the IADN central database.

- First the DBM examines each year's data and makes sure that the proper format has been followed, minimizes erroneous information introduced by the translation process, and ensures that all proper codes and flags have been inserted.

- The second check occurs before data are officially entered into the central database. The DBM will send a copy of the data set to each PI, who will double-check the final version for discrepancies with the original data.
- The last check is an assessment of the complete data set performed every two years by the Steering Committee, along with the QAM and the DBM. The purposes of this intercomparison may include:
 - Identify anomalies in the data sets (*i.e.*, numbers from one site that are significantly out of line with the others)
 - Compare the precision of different networks within IADN
 - Assess the precision of collocated samplers
 - Assess effects of differences in sampling and analysis among networks
 - Examine data for consistent biases for individual compounds
 - Compare method detection limits of different networks
 - Agree upon representative data sets for each pollutant in each lake

Corrective Action

Corrective action should be taken immediately to rectify any problems that are identified. Appropriate corrective actions might include changes to sampling and analysis procedures or to shipping and handling methods for samples.

If any problems or discrepancies are identified in the review and intercomparison of database entries, the PIs will be responsible for ensuring that proper corrective actions are taken. Corrective actions resulting from data reviews may be placed into two classes.

- The first is directed at discrepancies or problems that may be rectified by action within the data management structure. These may be a result of errors in file translation or data entry.
- The second category of corrective actions results from problems in the sampling or analytical methodology that are identified by their influence on the data set. Identifying problems of this type is the primary goal of the bi-annual data comparison meeting of the PIs, QAM, and DBM. Any data determined to be biased in such a manner should be flagged before being entered into the database. Feedback to the appropriate agency should occur when a corrective action of this type is implemented.

Data Security

The DBM is responsible for observing and implementing proper security precautions in the operation of the database. Important data security considerations include:

- Thorough screening of all data before entry into database
- Careful maintenance of backup copies of the database
- Only the DBM is to have authorization to write to or change the database

Project and national databases shall have similar requirements for data security.

Audit Trails and Configuration Control

All changes, revisions, or deletions to/from the database are accomplished using the RDMQ log and is stored in the database. This will be the responsibility of the DBM.

4.5 DATA RETRIEVAL AND REPORTS

It is the responsibility of the DBM, with the assistance of the SC, to facilitate user access to the data. Several aspects of this duty include:

- Provide standard statistical summaries
- Produce interpretive reports, maps, etc.
- Format data reports
- Provide standard data sets
- Provide special reports, as necessary

SECTION 5.0

QUALITY ASSURANCE ASSESSMENT

5.1 DESCRIPTION OF AUDIT PROGRAM

In order to ensure that adequate quality control and quality assurance plans are being fully implemented, each agency participating in the IADN Program should undergo a series of managerial and technical QA audits/reviews at both the program level and the project level. The schedules for audits described in this section are minimum frequencies: individual agencies may have more stringent requirements.

The IADN auditing program will consist of both internal audits (performed within individual agencies) and external audits (arranged by the QAM, and covering the entire IADN) of field, laboratory, and data management procedures. Each agency is responsible for documenting any significant QA problems encountered and corrective actions taken. These will be promptly communicated to the steering committee. Section 5.3 describes the annual use of performance evaluation samples in the program.

Three specific areas are targeted by the IADN external audit program:

- Sampling and other field operations
- Laboratory operations
- Data traceability

5.1.1 Audit Protocols

Individual audit protocols shall be developed for each activity selected for audit. The audit protocol development guidelines listed in Appendix L were designed to assist this process. The guidelines shall be used (or modified to suit any special circumstances) when planning any of the three audit types listed previously. A copy of each approved audit protocol shall be submitted to the IADN QAM for archiving.

5.1.2 Sampling and Field Operations Audit

The IADN QAM, is responsible for implementing biennial field audits of each site involved in data collection for the IADN. These audits are to include an assessment of the

compliance of each site with the IADN siting criteria, agency SOPs, and comparability among sites.

5.1.3 Laboratory Operations Audit

The IADN QAM shall arrange for biennial audits of all laboratories performing analyses of samples collected by IADN sites. These audits are to include an assessment of the compliance of each laboratory with the agency QAPjPs, SOPs, and a review of internal QA results.

5.1.4 Data Traceability Audit

Biennially, the IADN DBM shall perform a traceability audit on a limited sample of data points in concert with each agency. The traceability audit shall verify, for a random set of data, that the data in the database accurately represent the results of the data collection process. The data are to be traced from their origin in sampling and field operations, through laboratory analysis and data reduction and validation, to their entry into the database.

5.1.5 External Audit Reports

The results of each external audit, and any corrective actions resulting from it shall be made available to steering committee and each laboratory being audited.

5.2 CORRECTIVE ACTION

Each QAPjP or equivalent includes provisions for written requirements establishing and maintaining QA reporting and feedback channels to the appropriate management authority to ensure that early and effective corrective action can be taken when data quality falls below required limits or when a problem is identified by internal procedures or an audit.

Each agency implements a system for tracking corrective action requests and the actions that result from them. Short term corrective actions initiated by the laboratory or field operators or their supervisors (e.g., recalibration of instruments) are noted in the field logs or laboratory notebooks. Corrective actions resulting from requests by other network personnel or auditors should be documented. The IADN DBM is informed of any major corrective actions taken and

of any data loss in excess of the completeness goal. (Appendix G, Table G-16) The need for corrective action is minimized through up-front QA planning and management that establishes quality control checks on procured items, a program of preventative maintenance, and predetermined warning or control limits for measurement and analytical systems. There is a documented record (normally in the QAPjP of each agency) that describes when corrective actions are to be taken and who is responsible for ensuring that the corrective actions were taken and were effective.

5.3 QUALITY ASSURANCE PROGRAM

Soon to be released by the AdHoc QA Group....

5.4 PROGRAM REVIEW

As mentioned previously (Section 1.4.4), a summary of progress made under the IADN program is prepared by the Steering Committee at the conclusion of each Implementation Plan. This summary forms the basis for discussion at an external review of the IADN program.

The first such review was held in 1997, at the conclusion of the first Implementation Plan, and included a review of proposed future actions. The 2-day review consisted of:

- a review of documents provided to the science review panel;
- a one-day presentation of the IADN program and results by the Steering Committee, with a question/answer period;
- an evening review panel *in camera* session to discuss the presentation from Day 1 and to formulate questions for the IADN Steering Committee on Day 2;
- a morning open session on Day 2 to answer further questions formulated by the panel;
- an afternoon session on Day 2 for the science panel to write a consensus report, as well as their own individual opinions.

At this review, the Steering Committee sought answers to the following questions:

1. Did IADN do what it said it would do in IP1?

Did IADN meet the goals for monitoring and surveillance set out in the Great Lakes Water

Quality Agreement Annex 15? Where are the shortfalls against the mandate? What are the successes?

Did IADN meet the goals for monitoring and surveillance set out in the CAA Section 112?

Where are the shortfalls against the mandate? What are the successes?

Has IADN's progress been adequate? What is a reasonable rate and mechanism of delivery of this type of information to the scientific community, to policy makers, and to the public?

2. Was the work scientifically credible?

What was the overall *quality* of the research and monitoring being conducted under the IADN program?

Are the findings of the loads and trends credible?

How does IADN compare against the quality and standards of international networks to monitor and assess the deposition of POPs and heavy metals?

3. Was the work technically sound? Were the timing, monitoring and analysis techniques, network design, etc., adequate?

4. Based on new scientific knowledge, were the right questions asked in IP1 or did more important scientific questions go unanswered? Were IADN's priorities correctly placed? Were the right measurements being made? Were the right chemicals being measured?

5. Does IP2 correct for our current understanding of the issue or are there still important questions going unanswered which could be addressed by IADN? Does IP2 meet additional information needs?

Does IADN contribute to the current and future needs of the scientific community? Does IP2 improve on IADN's ability to deliver those models? What is missing? What is not necessary?

What role could IADN play in meeting additional research needs of Annex 15 and the CAA Section 112? What is missing? What is not necessary?

How best can IADN contribute to meeting the objectives of the Binational Toxics Strategy?

6. What are the greatest strengths and weaknesses in the IADN program?

The Report of the IADN Technical Review Panel contributed to the finalization of IP2. It can be found on the IADN Website at:

http://www.msc-smc.ec.gc.ca/iadn/resources/Peer_Review_Executive_Summary.pdf

SECTION 6.0

ADDITIONAL QUALITY ASSURANCE MATTERS

6.1 NON-ROUTINE SPECIAL STUDIES

Research activities are an important part of the Annex 15 program. Research studies are also essential to the further development of the IADN program. By their nature, research projects and other special studies are often of relatively short duration and limited scope. Developing a full QA program with complete documentation for each special study would consume disproportionate amounts of time and resources. However, an adequate level of quality assurance is necessary.

6.1.1 Quality Assurance Requirements

Special studies related to the IADN program may be placed into one of three categories, each requiring a different level of quality assurance:

1. Projects which support Annex 15 of the GLWQA, but are not directly IADN-related (*e.g.*, studies related to other terms of the loading equation or assessments of physical constants used in the loading equation) must be covered by a quality assurance plan or QA narrative statement, but are not subject to this QAPP.
2. Quality control studies and methodology assessments within the IADN (*e.g.*, interlaboratory comparisons, sampling comparisons) may have a direct effect on IADN methods and are therefore subject to the requirements of this QAPP.
3. Special projects which generate concentration data that are to be entered into the IADN database are subject to the requirements of this QAPP, and must also be covered by the QAPjP (or equivalent) of the agency performing the study.

6.1.2 Reporting Requirements for Special Studies

The PI and QCC of each agency will produce a brief annual report on the results and QA status of all type 2 and 3 special projects carried out under their authority (as described in section 6.1.1). The report must contain a summary of QA activities during the previous year and planned QA activities for the coming year for each special project. This report may be included as part of the agency's annual QA report and work plan, or it may be a separate document.

6.2 TRAINING

In order to promote acceptable data quality and ensure proper site operations, a solid training program is necessary. The purpose of a training program is to ensure consistency among the various sampling sites and avoid sample contamination. The PI will ensure that the following specific QA goals of the training program have been met:

- Distribution of current SOPs and technical manuals to all personnel
- Ensure that all personnel are familiar with any procedural changes, including annual reviews
- Ensure that all site operators are completely familiar with all aspects of site operation, including:
 - Equipment operation
 - Changeover and shipping procedures
 - Sample documentation procedures
 - Equipment maintenance
 - Health and safety procedures
- Ensure that all personnel have basic knowledge of the goals and operations of the IADN

The Laboratory QCCs will be responsible for confirming that training of laboratory personnel has taken place and that periodic reviews occur. Specific goals of the laboratory training program are similar to those listed previously for field personnel, with the additional requirement that all laboratory personnel be experienced with the lab equipment that they will be responsible for operating (*e.g.*, GC/MS, GC/ECD, etc.).

Before implementing new operational procedures and updates to SOPs and technical manuals, each monitoring group shall take steps to ensure that all staff are made aware of the changes and their implementation. After the changes have taken effect, the agency PI shall ensure that they have been properly implemented.

The responsibility for identifying technical and QA/QC training needs within the IADN Program is shared by the QAM and the SC. Technical and nontechnical personnel should be afforded the opportunity to enhance their skills and capabilities by attending training courses, workshops, meetings, and seminars as permitted within the constraints of the IADN program budget and schedule.

6.3 DOCUMENTATION AND DOCUMENT CONTROL

6.3.1 Documentation Archives

The PI for each agency is responsible for ensuring maintenance of an up-to-date archive of electronic and physical copies of all QA documentation, including QAPPs, QAPjPs, field and laboratory SOPs, audit protocols and procedures, and audit reports for the duration of the IADN program. The PI shall also ensure that any changes or revisions made to these documents are recorded. A chronological "diary" of revisions stored in a spreadsheet (or equivalent) may be used. The PI and laboratory QCC will be responsible for keeping the archives up to date. The PI shall notify the IADN QAM of any changes/revisions annually and supply updates of the chronological "diary" on a quarterly basis. This information is to be included in the agency annual report.

The IADN QAM is responsible for maintaining a central IADN documentation archive, which shall be kept by the IADN database manager as an adjunct to the central database(s). This archive shall contain physical copies of all QA documents from the individual data collection agency's files (QAPPs, QAPjPs, field and laboratory SOPs, audit protocols and procedures, audit reports, and records of revisions and changes to QA documents). The central documentation archive shall be updated annually. The central collection of chronological "diary" files shall be reviewed quarterly by the QAM.

6.3.2 Documentation for Field Sites and Laboratories

Each field site operator shall maintain a logbook which contains a record of all samples submitted, any sampling or instrumental problems encountered, corrective actions taken, calibrations of instruments, and preventive maintenance. Similar logbooks shall be maintained by laboratory analysts, containing records of all analyses performed, records of all samples received, calibrations and preventive maintenance, and notes of any problems encountered.

The PI shall be responsible for development of a Site Operator's Manual, which shall contain descriptions of all sampling equipment; instructions for operation and maintenance, including SOPs and procedures for troubleshooting and corrective actions; and QA procedures. The PI shall also develop a Technical Manual containing detailed descriptions of site

instrumentation, with schematic diagrams, manufacturer's instructions, and procedures for materials procurement, inventory control, preventative maintenance, and corrective actions.

The Laboratory QCC shall be responsible for development of a Laboratory Operations Manual, containing analytical SOPs, sample handling procedures, corrective actions, and QA/QC procedures.

6.3.3 Document Pagination

Documentation is necessary for the proper operation of the network and must be properly produced, updated, and distributed on a regular basis. A document cataloguing system which lists document type, identification number, title, author(s), date of publication, dates of revisions, and a user distribution list is to be maintained by each PI as part of the document archive. The IADN QAM is to maintain a similar catalogue as a part of the central IADN document archive.

All pages should contain the following information:

IADN QAPP
Revision: 1
Date: March 2, 1998

Section: 3
Page 2 of 5

This system allows for easy insertion of revised, updated, or additional pages into existing documents. Each major section should begin on a new page so that the revision of single sections can be done without affecting other sections. When pages are revised, they are to replace the old pages and a notation is to be made in the table of contents and in the chronological "diary" files of the PI and the QAM.

Documents subject to these requirements include QAPPs, QAPjPs and field and laboratory SOPs.

